

Assignment 13.3 Questions 1, 16, 59 – 63 odd, 64, 72, 73, 74

- 1) [A] will go down until equilibrium is re-established. It will still end up greater than the original concentration.
[B] will decrease [C] will increase [D] will increase.
- 16) a. False, in a heterogeneous equilibrium adding a reactant may have no effect. For example, adding more solid to a system that is in equilibrium with gases will not cause a shift.
b. False, K will remain constant
c. False, K will only increase with temperature if the forward reaction is endothermic.
d. False, changes in volume only affect equilibrium involving gases. Equilibrium would only shift left if the reactants had more moles of gas.
e. True. Adding a catalyst does not shift equilibrium position, but it will help the system reach equilibrium faster.
- 59) a. Right b. Right c. No effect d. Left e. No effect
- 61) a. Left b. Right c. Left d. No effect e. No effect f. Right
- 63) It would increase, because equilibrium would shift right to absorb the heat.

64) As the temperature increase, K_p decreases, meaning that the equilibrium is shifting to the left. Therefore the reaction must be exothermic.

72) a. $Q = \frac{1/2 [\text{FeSCN}^{2+}]}{1/2 [\text{Fe}^{3+}] 1/2 [\text{SCN}^-]}$ Doubling the volume will double the value of Q.
System will shift left to re-establish equilibrium.

- b. Left. Adding AgNO_3 will precipitate AgSCN , decreasing the concentration of a reactant (SCN^-)
c. Left. Adding NaOH will precipitate $\text{Fe}(\text{OH})_3$, decreasing the concentration of a reactant (Fe^{3+})
d. Right. All nitrates are soluble, so $\text{Fe}(\text{NO}_3)_3$ will release more Fe^{3+} ions which will cause the equilibrium to shift right.
- 73) OH^- ions neutralize the H^+ ions. The decreased concentration of a product causes equilibrium to shift right, producing more CrO_4^{2-} ions (yellow).

74) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})$

- a. If the reaction is endothermic, higher temps push equilibrium to the right.
b. Removing the product causes the equilibrium to shift right to produce more.
c. A catalyst causes the system to reach equilibrium more quickly.
d. Increasing pressure favors the side with less gas (products.)